UNIVERSITI TEKNOLOGI MALAYSIA

SECI 1513 - Sec 07

ASSIGNMENT 3 : Technology Information System, Smart Campus and Emerging Technologies

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UTM
UNIVERSITI TEKNOLOGI MALAYSIA

TECHNOLOGY INFORMATION SYSTEM, SMART CAMPUS, AND EMERGING TECHNOLOGIES

- APPLICATION OF 5G IN SMART CAMPUS
- SMART CAMPUS: THE JOURNEY STARTS HERE (COMMSCOPE MALAYSIA)
- 5G, WIFI6 AND EMERGING NETWORK TECHNOLOGIES (HUAWEI)

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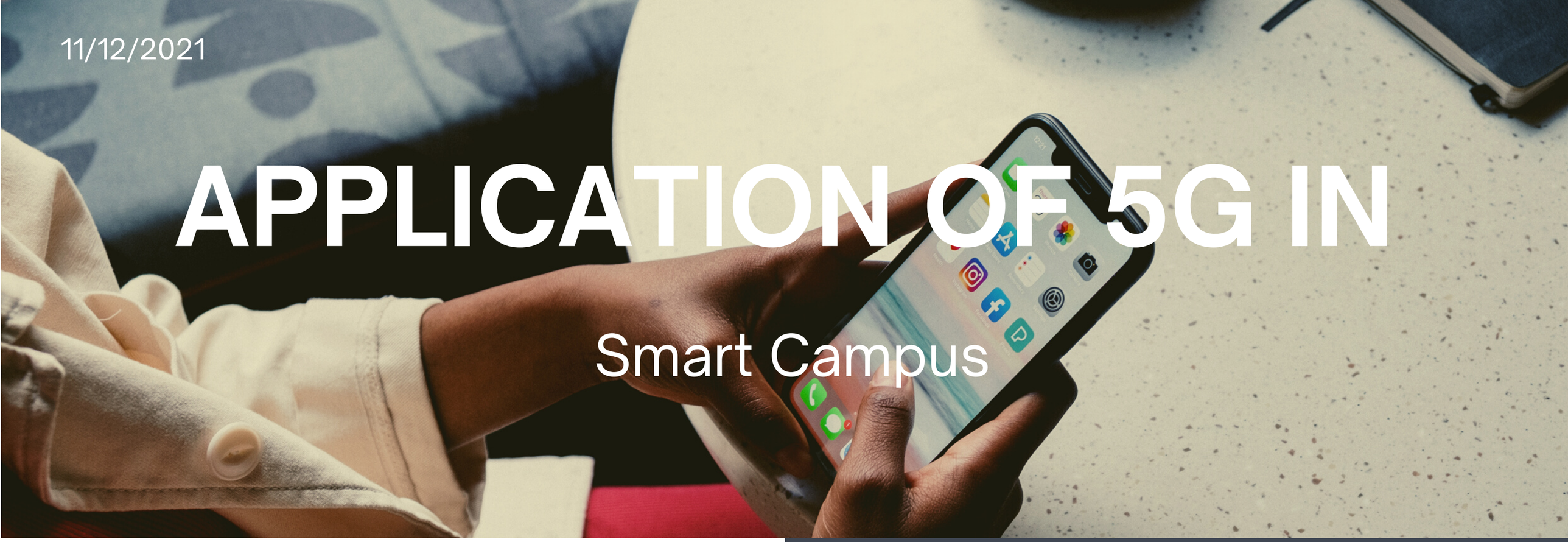
APPLICATION OF 5G IN

Smart Campus



Description of An Application of 5G in Smart Campus

One of the application of 5G in a Smart Campus is enabling the implementation of other Internet of Things (IoT) devices while maintaining the best user experience. 5G is a wireless technology that aims to deliver a higher multi-Gbps peak data speeds with very low latency. It is made to be more reliable, to hold massive amounts of network capacity, a wide availability area and to provide a more consistent user experience to users. Since Smart Campus will be utilize advanced technologies such as Augmented Reality (AR) and Virtual Reality (VR) in education, videos require a very strong internet in order to be played in 4K resolution for the best user experience while possibly be sent from long distances. Thus, 5G is necessary for the these types of scenarios. Besides education, 5G can enable 5G CCTVs and 5G drone inspection to be set up to revamp and improve surveillance across the campus. For example, the strangers and visitors in the campus can be identified accurately by first collecting the images of people with 360-degree cameras while sending the images to a cloud-based facial recognition technology to inspect the faces. All of these require 5G for it to be function perfectly. With the introduction 5G, quality of facilities will greatly improve while introducing new approaches of problem solving and service providing.

Reflection of The Application

The emergences of 5G in the technology world has certainly encourage all countries to progress towards Industrial Revolution 4.0. With the improvement of wireless technology, 5G has become extremely crucial in implementing Smart Cities, Smart Campus and many more. The importance of 5G has been highlighted by its great utility in various field within the Smart Campus. 5G is necessary for the operation of advanced technology within the Smart Campus. For example, the modernization of education by integrating IoT technology such as AR, VR in teaching. All of these required the assistance of 5G for the best user experience as the internet usage for the best quality resolution of VR and AR are very large. With low latency and more reliable, transmission of 4K videos and audios will be faster, clearer even at long distances simultaneously. Cloud-based technology such as Cloud PC, cloud VR can be implemented and operate smoothly as 5G is able to provide sufficient data transmission speed for it. Education quality will improve significantly and supervision of the Smart Campus can be managed systematically with 5G enabling the implementation of IoT devices. For the implementation of 5G, the study of 5G must be prioritize as it can be seen as a very crucial foundation in modernizing the cities and facilities. Expertise within the 5G field are become more demanding. Thus, resource for these expertise must be supplied for the progression of IR 4.0 and the implementation of Smart Campus.

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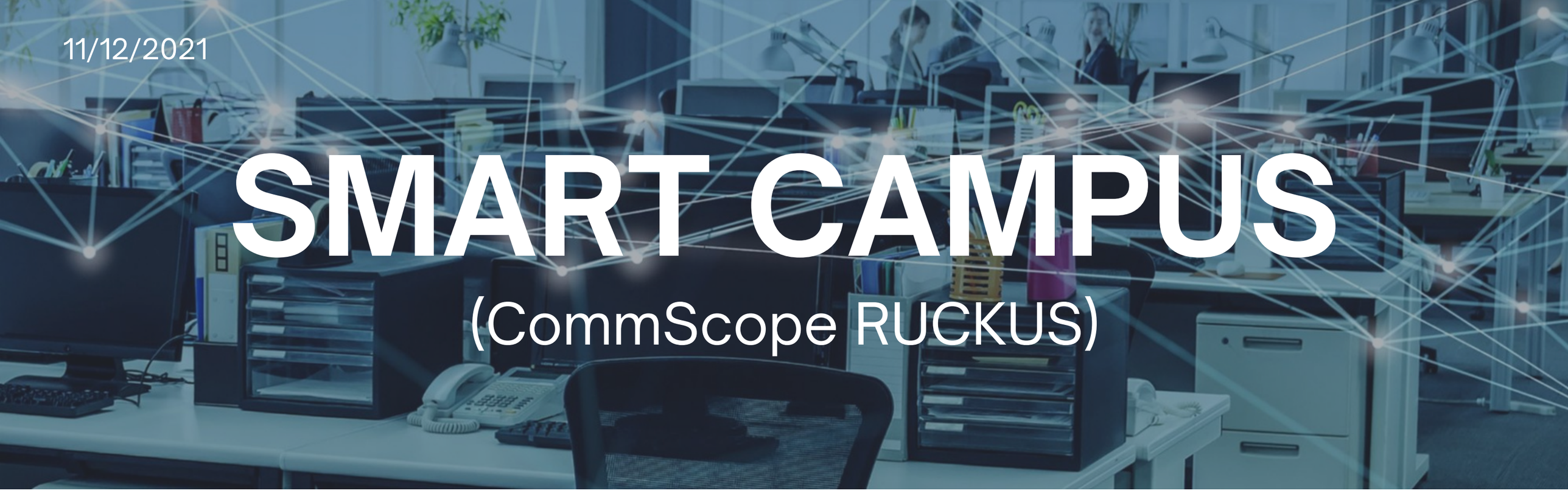

SMART CAMPUS

(CommScope RUCKUS)

Network Infrastructure

Network Infrastructure is the hardware and software resources of an entire network that enable network connectivity, communication, operations, and management of a corporate network are referred to as network infrastructure. It connects users, processes, applications, services, and external networks/the internet by providing a communication path and services.

Multigigabit Technology

Multigigabit Technology created in collaboration with the NBASE-T Alliance, leverages existing Cat 5e or Cat 6 twisted cable to give 2.5G, 5G, and even 10G speeds. It can solve problems like campus core that is under stress where there is a rapid increase in Wi-Fi speeds, the amount of IoT devices and Smart Buildings increases, 10x increase in wired edge speeds, and the increase in traffic of cloud applications and video streaming.

Unified Network Management

Traditional approach to On-Premises LAN/WLAN Network Management is using two network elements which are WLAN controller and Network Management System to centralized managing all the equipment but with Unified Network Management, it allows to manage all the access points and switches just using a network controller.

Internet of Things (IoT)

The Internet of Things (IoT) is a network of physical objects that are integrated with sensors, software, electronics, and connection, allowing them to exchange data more efficiently with other connected devices, the operator, or the manufacturer. The benefits of IoT are cost reduction, enhance customer experiences, increase efficiency and productivity and increase business opportunities.

Cloud Analytics

Cloud analytics is the process of using analytic algorithms in the cloud to analyze data in a private or public cloud and then delivering a desired result. Cloud analytics entails the use of scalable cloud computing in conjunction with strong analytic software to find patterns in data and derive new insights. It help to manage things that are too complex for humans to manage.

Devices Used in Network Infrastructure

11 types of devices that used in Network Infastructure :

- Firewall
- Switch
- Access Point
- Router
- Network Attached Storage
- Load Balancer
- Repeater
- Gateway
- Modem
- Hub
- Bridge

Wi-Fi 6

Wi-Fi 6 is the Wi-Fi standard's next iteration. Wi-Fi 6 allows businesses and service providers to support new and emerging applications on the same wireless infrastructure while giving older apps a higher level of service. The move to Wi-Fi 6 paves the way for new business models and a greater use of Wi-Fi. Wi-Fi 6 access points are already being used by some businesses.

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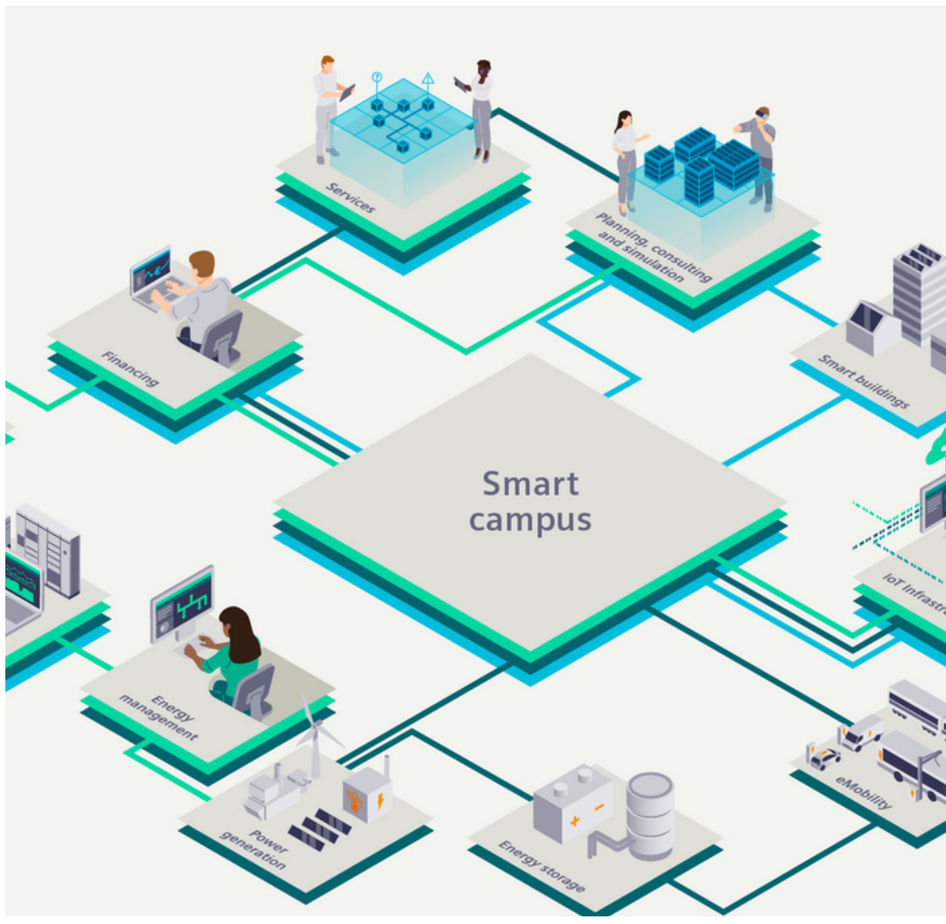
Example of domain

In education, students demand home-like internet connectivity in all areas of campus, including dorms and campus grounds. Universities must deliver modern campus experiences that are convenient, secure, and tailored to support tech-savvy, always-connected students. Voice-activated help, smart laundry machines, virtual health services, foodservice kiosks, mobile and contactless payment choices, and real-time occupancy systems are all examples of smart campus provide. In addition, accessibility is crucial. Students should be able to travel freely throughout campus and rely on services that are intuitive, convenient, and simple to use. As the pandemic COVID-19 recently, on-campus experiences have to adapt quick to accommodate the requirements of off-campus students. Focusing on user experiences through smart campus technologies allows students to have more inclusive and healthier experiences. Learners can customize their learning and living environments using a combination of immersive, automated, and interactive technologies.



In terms of security and safety, strong lighting and regular patrols are no longer sufficient to provide the protection that students and parents expect. Students and their families can have peace of mind thanks to internet-connected security services. Smart campus solutions assist in the prevention of crime while also raising awareness. Universities can implement intelligent technology to secure assets and people using reliable connected systems. For instance, smart locks, geofencing, and smart ID cards enable access control quick and easy. Additionally, students and staff who move alone to evening classes are assisted by location intelligence.

REFLECTION

A network structure is a type of organizational structure in which multiple organizations collaborate to produce and provide a good service or function to us. It is good to have a network structure as it has a lot of advantages. For example, it is more flexible, cost-friendly, and has a clearer focus. It will become the backbone of your daily operation which means it will help you to build up and provide a systematic flow. Nevertheless, there are some drawbacks of network structure. It is very difficult to control such a widespread network and lack of secrecy. Your company's confidential information may be leaked to competitors. There are various types of networks, such as PAN, LAN, MAN, and etc. They can be used via wired or wireless. Wi-fi is one of the examples of wireless networking technology that allows different types of devices like computers, mobile devices, and other equipment to interface with the internet, creating a network. Wi-Fi 6 (11ax) is the newest generation in today's network while 11a, 11b, 11g, 11n, and 11ac are older generations. It helps us to solve the technology limitations and provide the fastest internet speed to us. It is also one of the technologies used by the Internet of Things (IoT) devices to have the connection to other gadgets on the internet to automate certain tasks. Smart City, Smart Home, Smart Campus, and more are the innovations that use the IoT systems. There are three major features provided in Smart Campus which are Smart Living, Smart Learning, and Smart Safety. For example, smart ID cards, smart parking or transit, virtual labs, CCTV cameras, and etc. These will provide a better learning experience and environment to the students. It will also help us to reduce the operational cost and enhance the safety of the college campus.

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5G, WIFI6 AND EMERGING NETWORK TECHNOLOGIES (HUAWEI)

5G

The fifth generation of wireless technology systems is known as 5G. It delivers speeds that are comparable to those given via fiber-optic connections and are faster than any previous generation. Consumers may see real-world speeds of 700-3025 Mbps once 5G becomes generally available, according to early tests. Movies that took minutes to download with 4G will take seconds with 5G. 5G has a lot of benefits such as low latency to enable faster transmission of larger data streams, more reliability to enable better transmission data in extreme conditions like in the jungle, and more flexible than Wi-Fi and can support a wide range of devices, sensors and wearables.

DEVICES USED IN 5G

There was also 3 major 5G application scenario defined by ITU which is Enhanced Mobile Broadband(eMBB), Massive Machine Type Communications(mMTC), Ultra-reliable, and Low-Latency Communications(uRLLC).

Things like 3D video, work and play in the cloud, Augmented Reality(AR), Smart City, Smart Building, and more are all included in these 3 5G application scenarios. Augmented Reality, Virtual Reality, and automation in-vehicle, Smart Grid is high in business impact and 5G essential.

There were also 5G top potential industrial applications which include 5G smart medical, 5G smart manufacturing, 5G smart education, and more. When using 5G technologies like Smart Antenna will improve SNR expanding the coverage radius by 20%, and Smart Radio enables 10ms ultra-low latency and lossless roaming.

WI-FI 6

802.11ax was named Wi-Fi 6, which is a new revolution technology. Wi-Fi 6 supports Gigabit Broadband Promotion such as 1 Gbit/s to mobile, phones, and PCs and fast backup or download experience, the peak performance improved 33% from Wi-Fi 4 to Wi-Fi 5, and peak performance improved 25 % from Wi-Fi 5 to Wi-Fi 6. For Wi-Fi 5, the transmission time is 3.2us/time and can carry 234 subcarriers but for Wi-Fi 6 the transmission time is 12.8us/time and can carry 980 subcarriers. For the speed test, video or games that take minutes to download will take 20 seconds using Wi-Fi 6, which is pretty fast. Wi-Fi 6 can cover a full house of 5 GHz signals because of the Wi-Fi 6 chip RF optimization, improving the TX power and sensitivity under the same signal quality and dedicated algorithm to improve performance and omnidirectional coverage when connecting to traditional Wi-Fi 5 STAs.

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DEVICES USED IN WI-FI 6

Wi-Fi 6 also comes out with new video services like multi-screen IPTV, online HD video teaching, cloud VR interaction, and eSports acceleration. In Wi-Fi 5, Wi-Fi 5 uses OFDM which is a single lane without traffic lights and CCA power adjustment. On the other hand, Wi-Fi 6 uses OFDMA which is multiple lanes with traffic lights and BSS coloring. Wi-Fi 6 supports a better multi-user experience as more than 100 terminals are connected and the power consumption of terminals is reduced by 30%. About the core technology of Wi-Fi 6, Wi-Fi 6 is using 1024-QAM 8 x 8 MU-MIMO which up to 9.6 Gbit/s rate and 4X larger bandwidth, UL/DL OFDMA and UL/DL MU-MIMO which has 1024 terminals on a single AP, OFDMA Spatial Reuse that reduces latency to 20ms, and TWT 20 MHz-Only which reduce 30% power consumption

HUAWEI AirEngine Wi-Fi 6 technologies give us the highest performance in gaming, most stable experience, most comprehensive IoT apps, and more security. HUAWEI AirEngine Wi-Fi 6 is using 16x16 MU-MIMO, smart antenna, Dynamic Turbo, Lossless roaming, IoT expansion through the USB port, hardware encryption, and more. It provides 2x more speed than industry Wi-Fi 6 and has Real-Time performance. The device that uses HUAWEI AirEngine Wi-Fi 6 is AirEngine 8760-X1-PRO, which had been tested and has a PHY rate of 10.75 Gbps.

EXAMPLE OF DOMAIN

Wi-Fi 6 delivers plenty of new features and capabilities that will have a large influence on IoT in manufacturing. To this end, the Wireless Broadband Alliance (WBA) recently announced a series of WiFi 6 trials with Mettis Aerospace, the company that designs and manufactures forged components, machines and sub-assemblies. precision, mainly for the aerospace and defense industries. A variety of industrial enterprise and IoT use cases, including multi-stream live video monitoring, real-time energy monitoring, ultra-reliable low-latency communications with sensors on vital systems, and augmented reality, will be trialled as part of the collaboration.

In healthcare, medical professionals can use AR and VR for remote technology.According to medical specialists, Wi-Fi 6 and 5G should make it feasible to transmit healthcare across great distances more successfully than ever before due to their high speed and low latency. This is due to the fact that data transmission from faraway areas can be done in actual time. As a result, doctors and specialists will be able to diagnose, treat, and monitor patients hundreds or even thousands of miles away in a timely and precise way. Remote surgery, in which surgeons manage robots to perform an operation, is the apex of telemedicine.

In education, students can get a completely immersive learning experience through VR and AR technology. Wi-Fi 6 and 5G used in VR technology, educators and students are able to communicate and learn in a variety of ways. In a virtual reality, Wi-Fi 6 and 5G enables learning through high-quality videos. For example, virtual reality enables kids to study numerous components of the planet and universe. As a result, rather than the boring typical classroom setting, it makes the class more fascinating and encourages students to participate completely.

REFLECTION

The fifth-generation wireless, 5G is the latest generation of wireless technology systems. There are two major views or important aspects when we mentioned about 5G, the high bandwidth and the low latency. With 5G, data transmitted over wireless broadband connections can now travel at multigigabit speeds. It also helps to improve and advance autonomous driving, the Internet of things, and the manner in which our businesses access, store, share and protect data. It allows the internet to speed up to 10Gbps which is faster than 4G and 3.5G and it is more flexible than Wi-Fi. The example of 5G future use cases are augmented reality (AR), virtual reality (VR), driver information, and more. From an education perspective, it helps to provide a better learning experience to the students by providing a 3D object which the students can move around or rotating it to have a better understanding through remote class learning.

Wi-Fi is a wireless technology used to build up a connection between the devices like computers, smartphones, and more and the internet. WiFi is also a short name for Wireless Fidelity. Wi-Fi 6 (802.11ax) is the latest generation in today's network and it has been verified for more than 3 years since 2017. Wi-Fi 6 helps to provide a greater data transfer speed and internet speed. Wi-Fi 6 has solved many technical limitations faced by Wi-Fi 5. For example, Wi-Fi 6 has a larger coverage, larger access point capacity, greater channel width, and more efficient bandwidth sharing compared to Wi-Fi 5. also supports a better multi-user experience. For example, it can reduce the terminal power consumption by 30% through the new "target wake time" (TWT) function which causes the terminal to wake up on demand. It is also safer to use compared to the older generations.

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